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THE USE OF THE COMPUTER FOR TESTING, PROGRAMMING AND INSTRUCTION.

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DESCRIPTORS- *COMPUTER ORIENTED PROGRAMS, *COMPUTER ASSISTED INSTRUCTION, READING CENTERS, READING INSTRUCTION, LEARNING PROCESSES, SAN BERNARDINO VALLEY COLLEGE, CALIFORNIA,

THE READING CENTER AT SAN BERNARDINO VALLEY COLLEGE RELATED COMPUTER USES TO FOUR ASPECTS OF ITS READING PROGRAM--DIAGNOSIS, INSTRUCTION, EVALUATION, AND RESEARCH. A SYSTEMS DESIGN FOR THE TOTAL PROGRAM WAS DEVELOPED THROUGH THE PRACTICAL CONCERNS ASSOCIATED WITH THESE FOUR ASPECTS. THE FOLLOWING ARE THE OBJECTIVES OF THE VALLEY COLLEGE PROGRAM IN ITS SYSTEMS APPROACH--(1) TO ASSURE SEQUENCE AND CONTINUITY IN THE READING PROGRAM WHILE PROVIDING CURRENT DATA ON STUDENT ACHIEVEMENT, (2) TO CONTROL AND FOLLOW STUDENT PROGRESS, (3) TO KEEP THE TEACHER INFORMED ABOUT INDIVIDUAL PROGRESS, (4) TO PROVIDE A MORE EFFECTIVE MEANS OF PROGRAMING STUDENTS INTO MATERIALS AND MEDIA, (5) TO ASSURE INDIVIDUAL STUDENT PROGRESSION WITH THE SKILLS HE NEEDS TO WORK ON IN SEQUENCE, AND (6) TO HAVE THE POTENTIAL OF BRANCHING, SINCE THE TEST DATA CAN INDICATE ADDITIONAL SKILLS MATERIAL AVAILABLE THROUGH STORAGE IN THE MEMORY BANKS OF THE COMPUTER. SOME SPECIFIC APPLICATIONS OF THE USE OF THE COMPUTER ARE REPORTED. A COMPARISON OF COMPUTER FUNCTIONS AND LEARNING FUNCTIONS IS MADE. NINE REFERENCES ARE GIVEN. THIS PAPER WAS PRESENTED AT THE NATIONAL READING CONFERENCE (ST. PETERSBURG, FLORIDA, DECEMBER 1-3, 1966). (RH)

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THE USE OF THE COMPUTER FOR TESTING, PROGRAMMING AND INSTRUCTION

Directors of reading programs at all levels accumulate files of data most of which are manually maintained and therefore often inaccessible. Diagnostic information, instructional followup and evaluation data are often only partially used.

As a student advances through a reading program the increasing amount of data further compounds the problems of accessibility. Much overlapping and duplication resides in the files and on the conscience of the reading specialist concerned about maintaining sequence, continuity and individualized instruction. He bears his guilt reluctantly as the burden of data mounts.

Computer applications through a systems approach to reading programs offer a promise of reassurance to the reading specialist. Pertinent data acquired in diagnosis can be stored in a more available manner and synthesized with instructional procedures.

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Evaluation procedures, computer processed, assures immediate follow-up and control to the instructional process in addition to providing valuable research potential.

Systems approaches to the instructional program have been a natural result of efforts to develop a more efficient means of handling data. The Reading Center at San Bernardino Valley College has related computer uses to four aspects of its program: diagnosis, instruction, evaluation, and research. A systems design for the total program has been developing through the practical concerns associated with these four aspects. It should prove helpful first to offer a definition of what is meant by a systems approach to reading instruction, and then report on some specific applications of the use of the computer. Finally a comment on the direction indicated by a systems approach would be in order.

Every instructional situation is a composite of variables including the nature of the learner, the difficulty of the material, the terminal objectives of instruction, the instructional environment, the varieties of media, and the goals and policies of the educational institution.

A system is a set of well-defined parameters composed of learning situations. It identifies the operations and stipulates the relationship operations hold for each other as well as their relationship to the learning objectives. These are dynamic elements, and this paper will identify the learning theories which relate to the use of these elements.

Leonard Silvern relates learning to Blooms' Taxonomy suggesting that the systems approach is an application of analysis and synthesis to an instructional program. Analysis consists of identifying, relating, separating, and limiting elements which comprise the process of breaking down a whole. Synthesis involves creating a new relationship from these elements. The strength of learning systems rests in the analysis of alternate pathways through which desired terminal objectives may be obtained. Reading data so processed could do much to facilitate individual instruction.

Systems approaches emphasize the need for clear definition of terminal objectives. These in turn shape the teaching objectives. All possible inputs of stimuli are recognized and arranged in a hierarchical order. Diagnostic measures, computer stored perhaps, summarize the knowledge and skills already within the training achievement levle of the students. These identified objectives need to be properly communicated to the student and the instructional sequence related to them.

At this point a description of the computer applications at San Bernardino Valley College should offer an example. Valley College conducts a reading program involving approximately one thousand of the college's five thousand students. The initial concern with using available data was to evaluate the reading levels and specific reading skills problems of these thousand students and program them into appropriate courses. These students were primarily selected on the basis of high school records, pre-testing, and individual interviews

conducted during reregistration. The total group included students with all ranges of ability. Enrollment may be voluntary or required depending on diagnostic data and staff recommendations.

The first meeting of the class the Nelson/Denny was administered using data processing materials on mark sense cards. In the future tests will be scored with an optical scanner using standard size scoring sheets. The answer key and standard norms to the Nelson/Denny were then programmed into the computer along with special program requests asking for supplementary data regarding the group tested. Test data and supplementary information processed by the computer provides such data as: frequency distribution, item analysis, means, medians, modes, and standard deviations. In addition, a printed student record label for each student listing percentile scores was provided. Class lists were provided with preliminary diagnostic breakdown. All of this data was available the second day of class.

Considerable instructional data on specific reading skills is also available in the form of a frequency count on each item of the test. By doing an item analysis using Blooms' Taxonomy of Educational Objectives, it is possible to classify the types of specific comprehension problems which particular groups need. It was also noted that the test itself is somewhat limited in questions measuring cognitive skills on upper levels such as analysis and synthesis. Computer analysis of the Nelson/Denny helps identify special comprehension problems of particular individuals. Additional analysis identifies the difficulty level of certain questions and the efficiency of each item to discriminate

between comprehension problems of high and low readers. An analysis of vocabulary indicates particular student problems such as specific re-curring prefixes and suffixes which relate to meaning. Finally, the computer "read out sheets" clearly reflect the apparent relationship between rate and comprehension. The final items on the comprehension section make it evident that students scoring in the upper quartile were handicapped by obvious time limitations. From this it may be concluded that rate development with upper level groups is important.

Computer applications to instruction have been numerous and most Helpful. Listed below are some of the objectives the Valley College program seeks to include in its systems approach.

A COMPUTER APPLICATION FOR READING INSTRUCTION

A. Major Objectives

1. To assure sequence and continuity in the reading program while providing current data regarding student achievement.
2. To control and follow the student progress along the developmental reading skills sequence.
3. To keep the teacher informed about individual progress with reading instruction.
4. To provide a more effective meand of programming students into materials and media.
5. To assure individual student progression with the skills he needs to work on in sequence, avoiding needless repetitions or gaps in the instructional process.
6. To have the potential of branching since the test data can indicate additional skills material available through storage in the memory banks of the computer.

Research applications of the computer have grown out of evaluation procedures at Valley College. Initally the program has attempted to recapitulate by testing the progress of individuals and groups in order to evaluate the effectiveness of instruction and facilitate

grading. A study is being made on correlations between various intelligence tests and reading tests administered to specific ability levels. A correlation study relating reading instruction to success in English and other content areas will continue through 1967-68. The computer has served as an invaluable tool in making these studies possible.

References to computer concepts need not lead to a distortion of the primary importance of sound learning theory and its relationship to educational systems. The impact of computer technology need not represent any more overriding role than teaching machines and programmed instruction have assumed, although its potential is greater. All three constitute useful tools to the systems approach in helping expand the potential of the media.

Individual differences are a basic concern of behavioral psychologists. Detailed analysis of large numbers of students in day to day reading skills instruction and evaluation of student progress is an insurmountable task. Computer collection, storage and evaluation of data holds great promise for increased attention to individual problems.

Immediate reinforcement and overt correction procedures are additional learning principles which computer processing could facilitate. Suppes comments on other studies demonstrating the desirability of overt correction procedures to facilitate learning. A systems approach would utilize the computer for scoring material as a means of reducing the time between student completion of an assignment and the time when it is returned with corrections.

The use of the computer has contributed significantly to the theory of learning. A comparison of computer functions and learning functions will illustrate the problem solving similarity. Computer functions include:

1. Input of information
2. Storage of data and retention of information
3. Logicjunit where calculations and decisions are carried out
4. Control is maintained, action is coordinated
5. The output unit which gets information out of the system as a whole

In comparison, the normal problem solving process follows these steps:

1. Input - a problem is written down
2. Storage is the registering of this data in thought
3. Calculation is the solving of the problem, obtaining the answer
4. Output - writing it down
5. Control is assumed throughout the brain

The use of this computer procedure holds great promise for systems analysis of learning research and teaching effectiveness.

USES OF SIMULATION

Systems approaches to learning frequently employ simulation through use of a computer as a new segment of learning research. Simulation of behavior is a means of studying a person of animal in which the computer is used as a dynamic but controlled model of the organism. In the simulation of neural and psychological behavior, the computer can be programmed for each step of its operation, making it possible to study behavior in greater detail/ In Frontiers of Psychology, Mann points out that this computer-aided research reveals that the nervous system operates in the manner of an infor-

mation processing system. The neural system is active in the sense that it is engaged constantly in various matching procedures designed to fit in-coming signals.

Learning may be separated into three basic processess: acquisition, retention, and transfer. And systems analysis may be related to the basic learning processes of acquisition, retention and transfer.

Acquisition means the performance is changed as a result of the learner's practice. Steps preceding practice include motivation and orientation. Systems development would indicate an organization plan employing media to point out the usefulness of what is to be learned and how it relates to post-learning. Orientation means that the learner must understand what he is to do and the processes involved. Orientation may will use TV and sound media to assure clear verbal description.

A systems approach would provide unique opportunity for use of programmed material, simulation, and special media. The learner should be given an opportunity to look at the whole task. Practice needs to be distributed with short periods of work and rest.

Programmed material provides opportunity to provide the learner with knowledge of results. Learners know how they are doing. It is important, however, that the knowledge of results be immediate. The greater the feedback, the greater the learning. Computer programming assures this feedback or suggests branching activities.

Systems application of the use of the computer offers great promise as a self organizing element. Experiements currently going

on reveal how the computer assists in getting maximum utilization of faculty skills by offering adequate diagnostic data for individual followup. Two basic aspects of the computer are its speed and accuracy. Racing of individual students and control of content become possible due to the constant feedback at all stages.

During the acquisition stage, programmed material can be employed as one of several resources available to the system. A record of reading skills lessons stored in a computer memory system linked to background data on the student himself assures a more systematic means of distributing practice. Such linkage would allow for immediate knowledge of results as well as maintain accurate records for prompt followup.

A systems approach attempts to reduce the degree of similarity among the parts of the task. The difficulty and the amount of the material learned is also controlled. Interferences can be more effectively dealt with by control of the learner's developmental progression through a program.

The process of transfer is acquired through more sophisticated control. The similarity of learning situations reflects a respect for stimusus-response relationships. Positive and negative transfer can be handled more systematically. Evaluation of progressin specific skills training can be computer controlled and followup drill offered at the earliest possible moment.

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CONCLUSION

It is apparent that the use of a computer means much more than getting test results bank in a hurry. The use of thchnology necessitates re-thinking the entire process the reading specialist pursues in developing his program. A useful tool offering great flexibility is at the reading specialistss disposal. For those concerned about surrendering control to the monster it should be remembered that before man let the genie out of the vase, man set theconditions as to how the genie would serve him.

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